



# GOES-17 Saturation Prediction Reference Tools for 2020

**Matthew Seybold and Seth Iacangelo**



Data are based on NESDIS/OSPO File “\*\_2020\_ABI\_Thermal\_Model\_2020-07-28.xls”



# Outline of Saturation Prediction Reference Tools

- Caveats & Assumptions
- Daily Maximum Temperatures
- Daily Maximum Temperatures with Band Thresholds
- Hour-by-Hour Band Saturation
- Interpretation of Marginal and Unusable Hours
- Example Images of “Marginal” and “Unusable” Hours
- Details on Cooling Timeline



# Important Caveat

- NOTE: All of the information in this slide deck is predictive.
- The actual extent of saturation will differ from the predictions by both temperature magnitude and time of day
- Differences between actual and prediction may also have seasonal variations
- The data in this slide deck indicate “marginal” saturation when imagery is still useful, but some saturation artifacts are present (see example imager at end of slide deck)
- In coming months the predicted data will be revisited and in cases where the predictions may be improved, this slide deck will be updated and redistributed
- Predictions for 2021 will be made available in late 2020



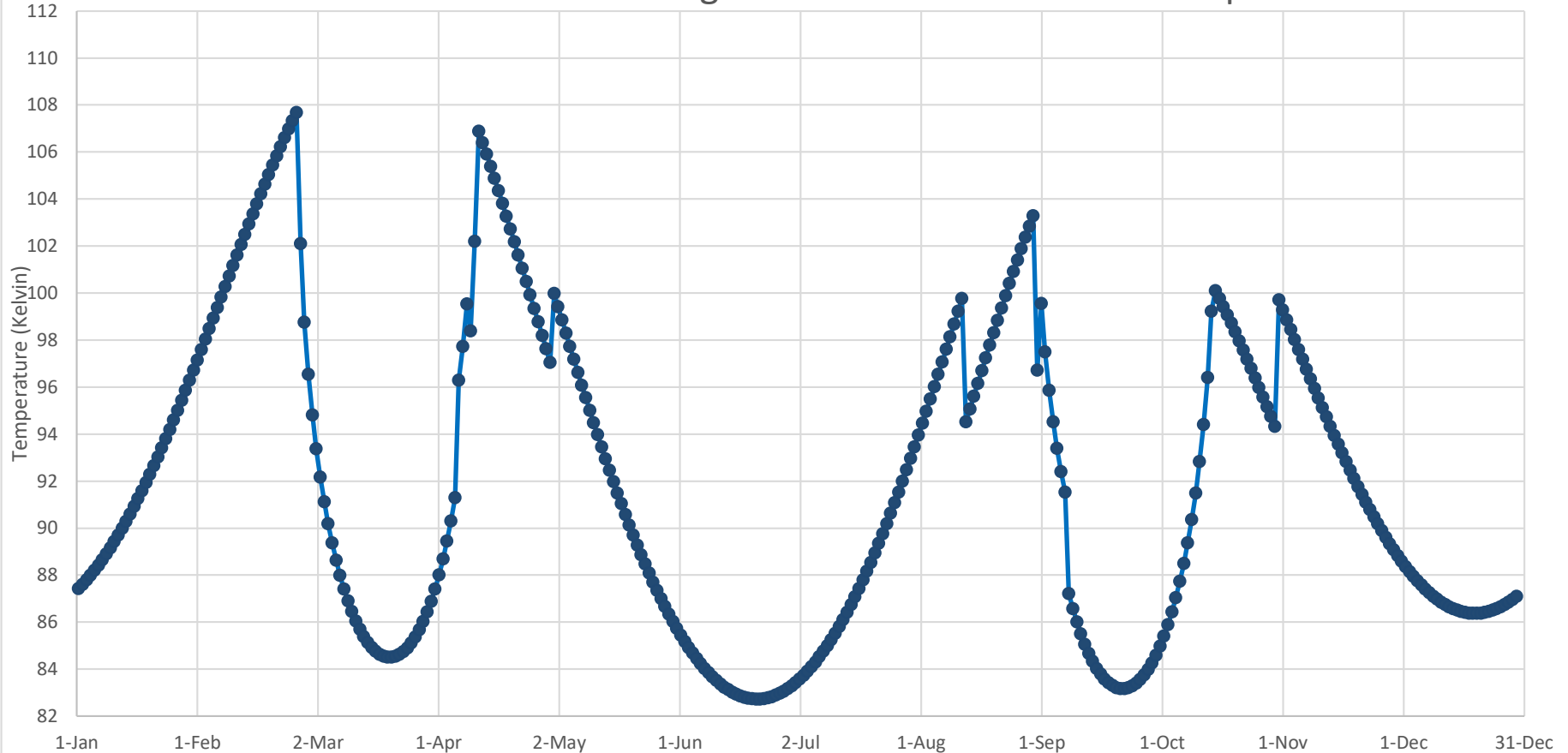
# Assumptions

- Inclusions reflect current (July 29, 2020) operational status
  - Thermal model uses Mode 6 with GOES-West mesoscale domain sector (MDS) default locations over Alaska and California
  - Semi-annual yaw flip to reduce solar load (~3 weeks after and before each equinox – April 6, 2020 and September 8, 2020)
  - Predictive Calibration is included in setting the “marginal” and “unusable” per-band imagery thresholds
  - Mode 3 Cooling Timeline: 15 minute Full Disk, 2 MDS Domains each at 2 minute refresh
    - See slides 17-20 for explanation of cooling timeline



# Predicted Daily Maximum Temperatures of Focal Plane Module (FPM)

GOES-17 Predicted Peak Longwave Infrared Focal Plane Temperature

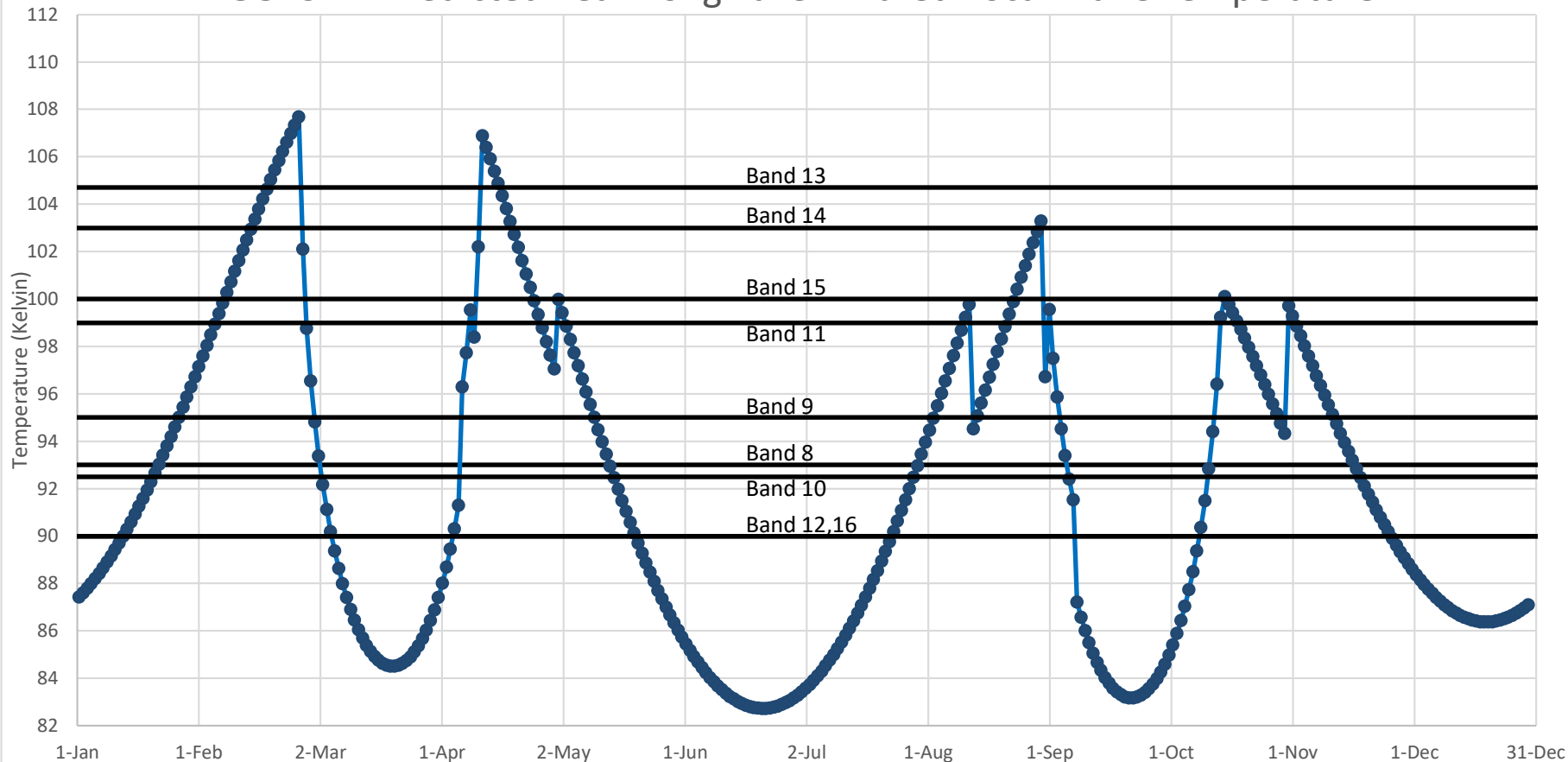


This plot shows daily maximum temperature of the ABI focal plane module. These maximums occur at night. The higher the temperature, the more saturated imagery becomes.



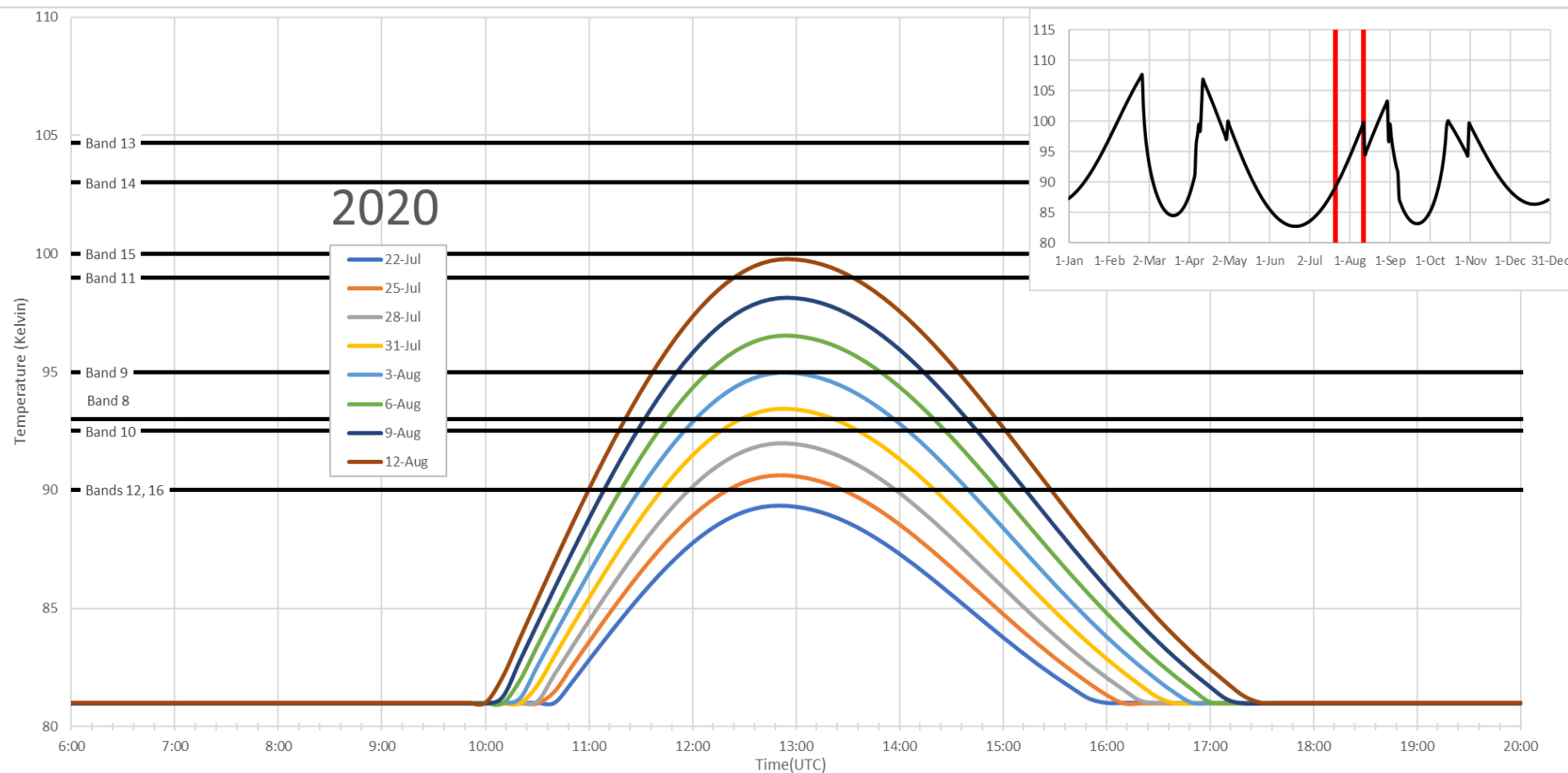
# Predicted Daily Maximum Temperatures of Focal Plane Module (FPM) with Marginal Saturation Thresholds for Each Band

GOES-17 Predicted Peak Longwave Infrared Focal Plane Temperature



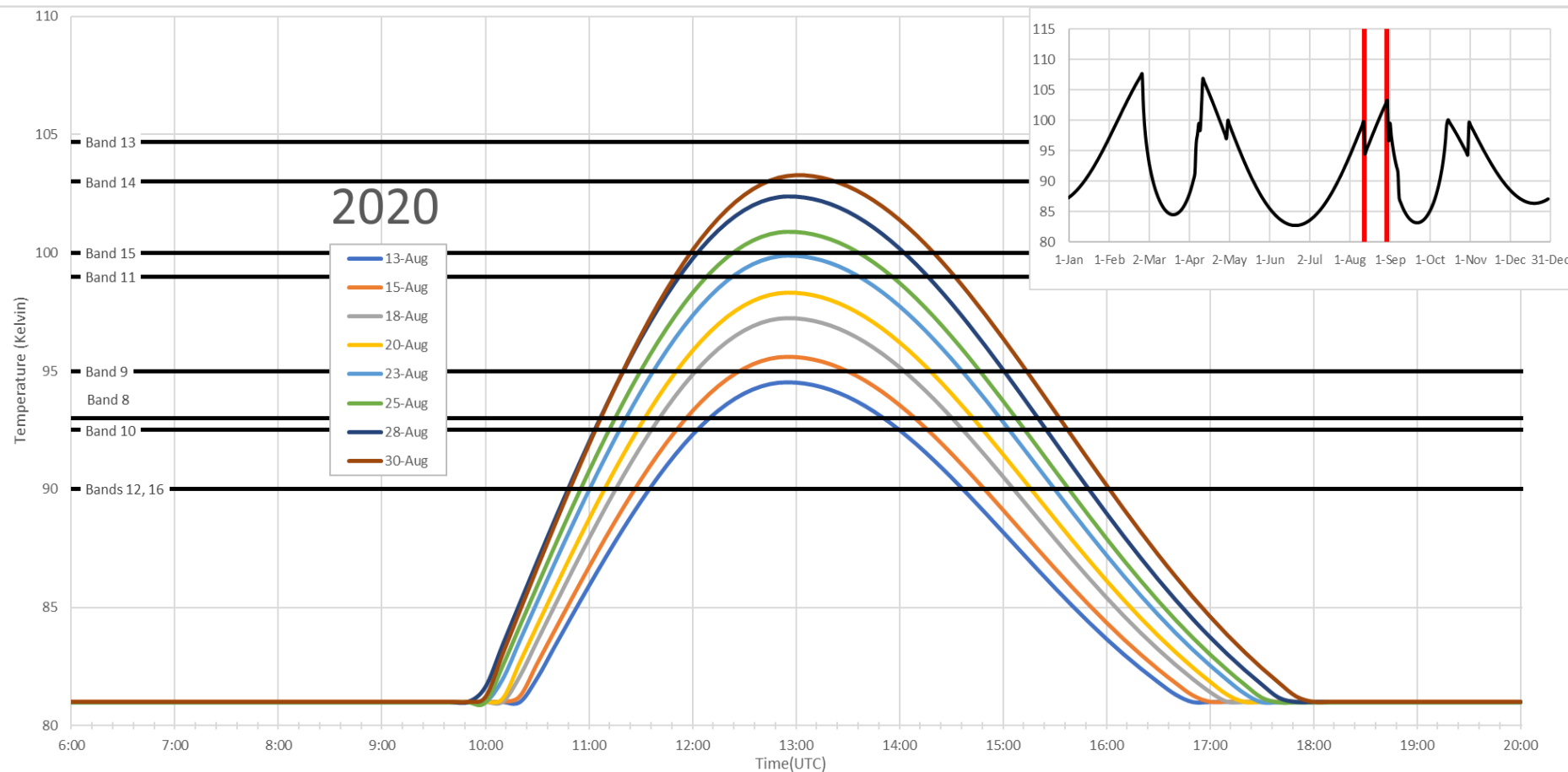
This plot shows daily maximum temperature of the ABI focal plane module. These maximums occur at night. The higher the temperature, the more saturated imagery becomes. Where the temperature rises to approach a black line for each band, marginal saturation may be observed in imagery. Where the temperature curve exceeds a black line for each band, the imagery may begin to saturate so much that it becomes unusable.

# Predicted Marginally Saturated Hours by Band



This plot shows hourly maximum temperature of the ABI focal plane module. The higher the temperature, the more saturated imagery becomes. Where the temperature rises to approach a black line for each band, marginal saturation may be observed in imagery. Where the temperature curve exceeds a black line for each band, the imagery may begin to saturate so much that it becomes unusable. The hour of peak temperature varies from day to day.

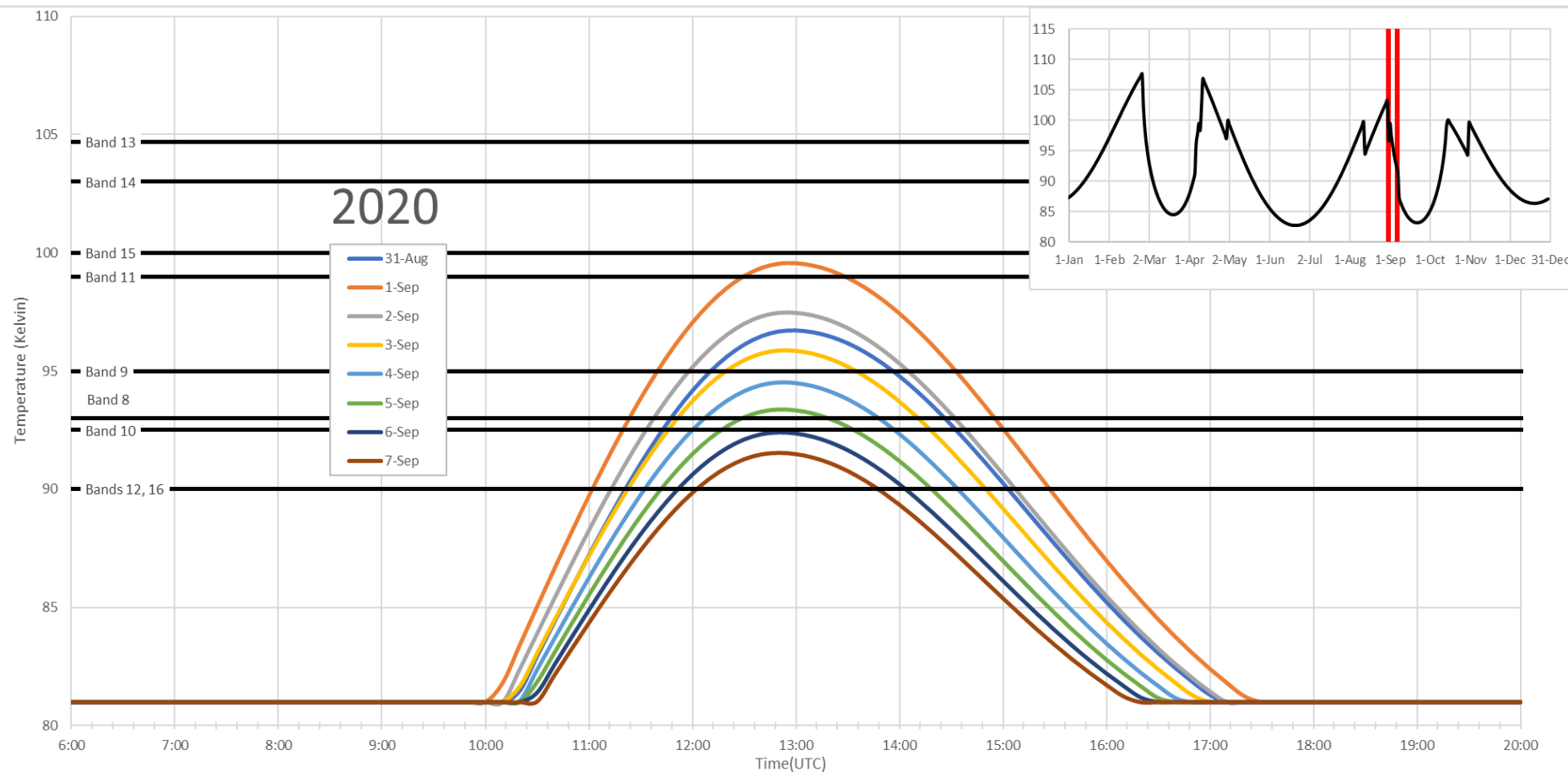
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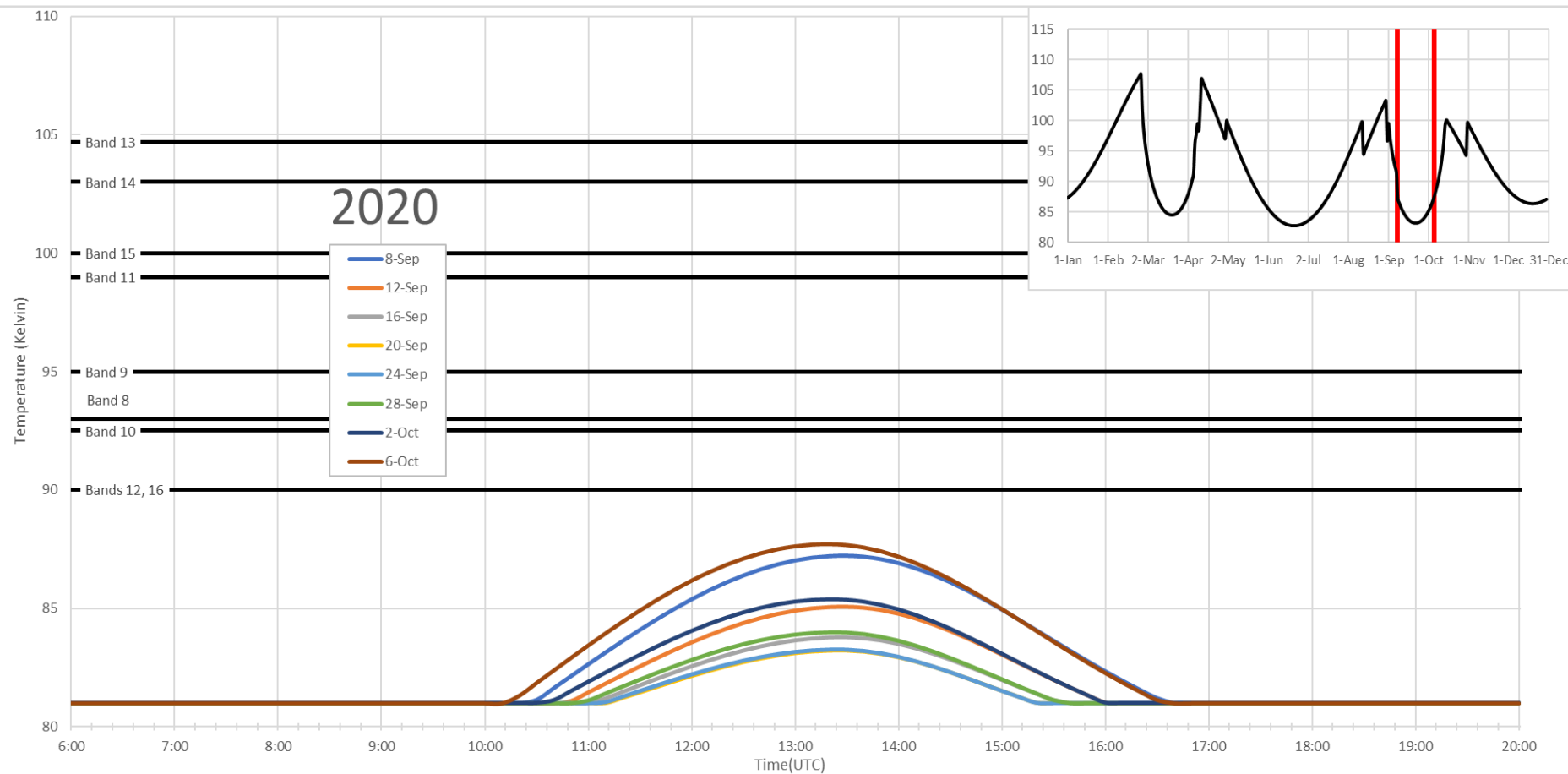
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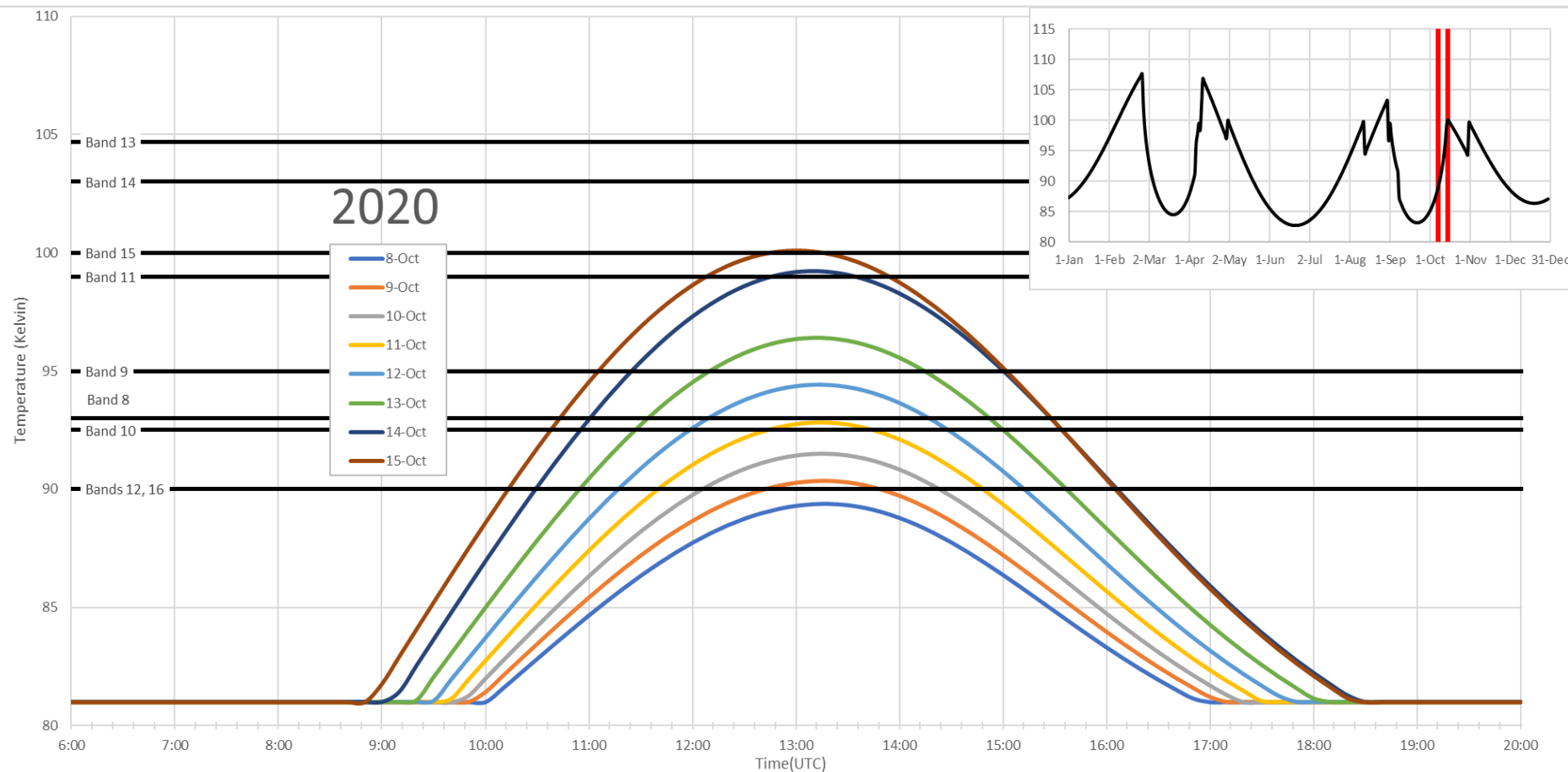


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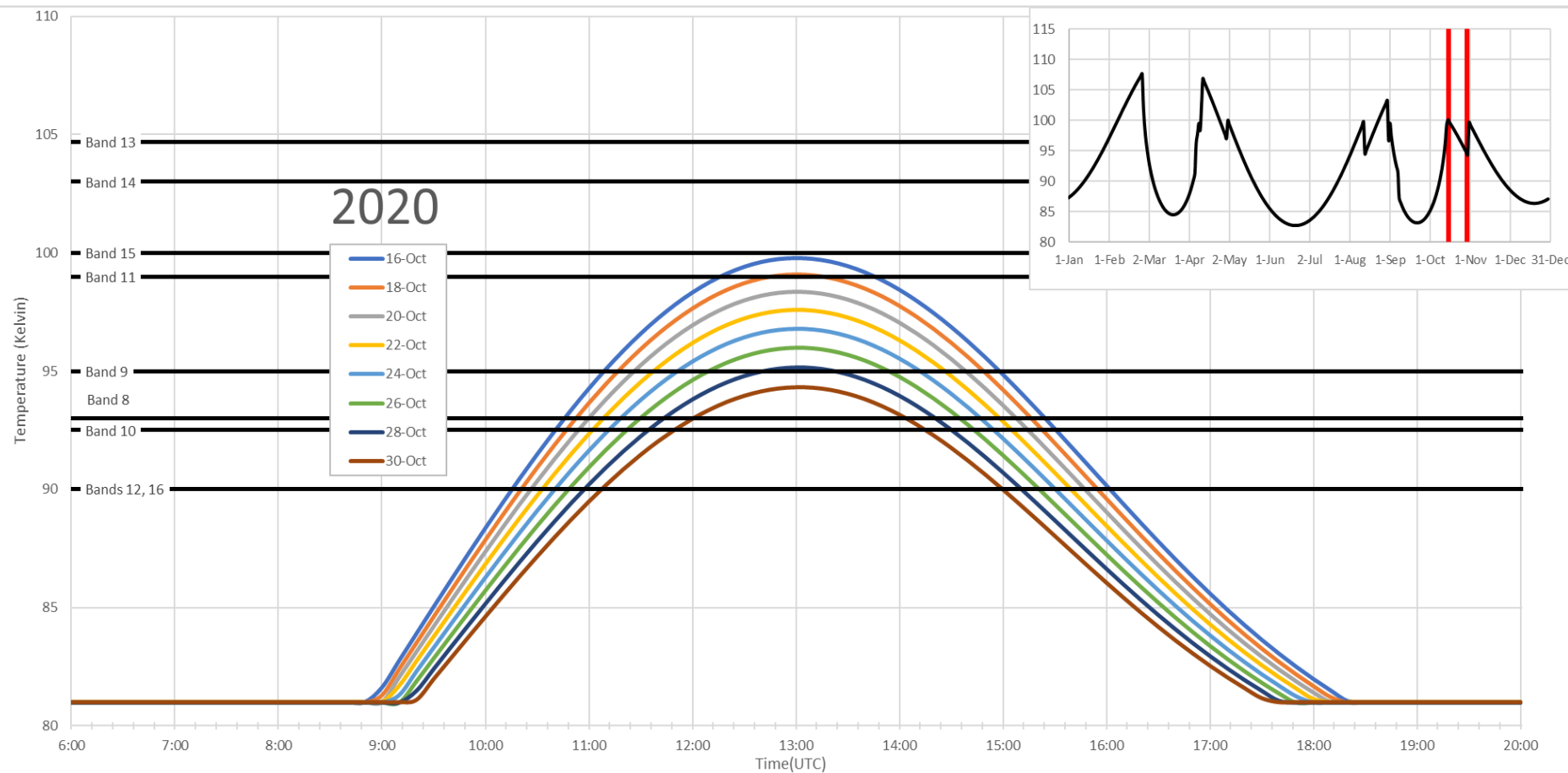
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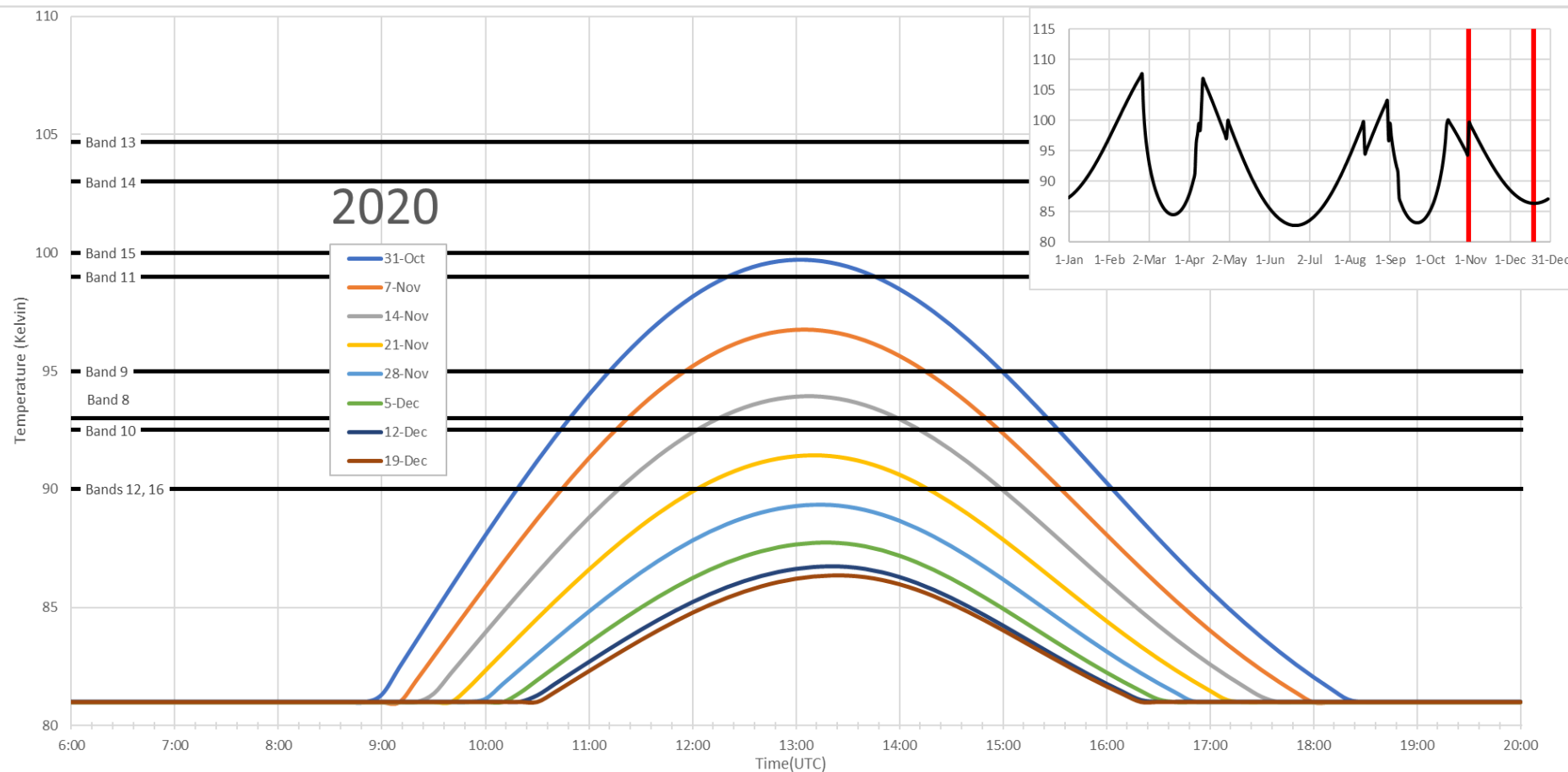
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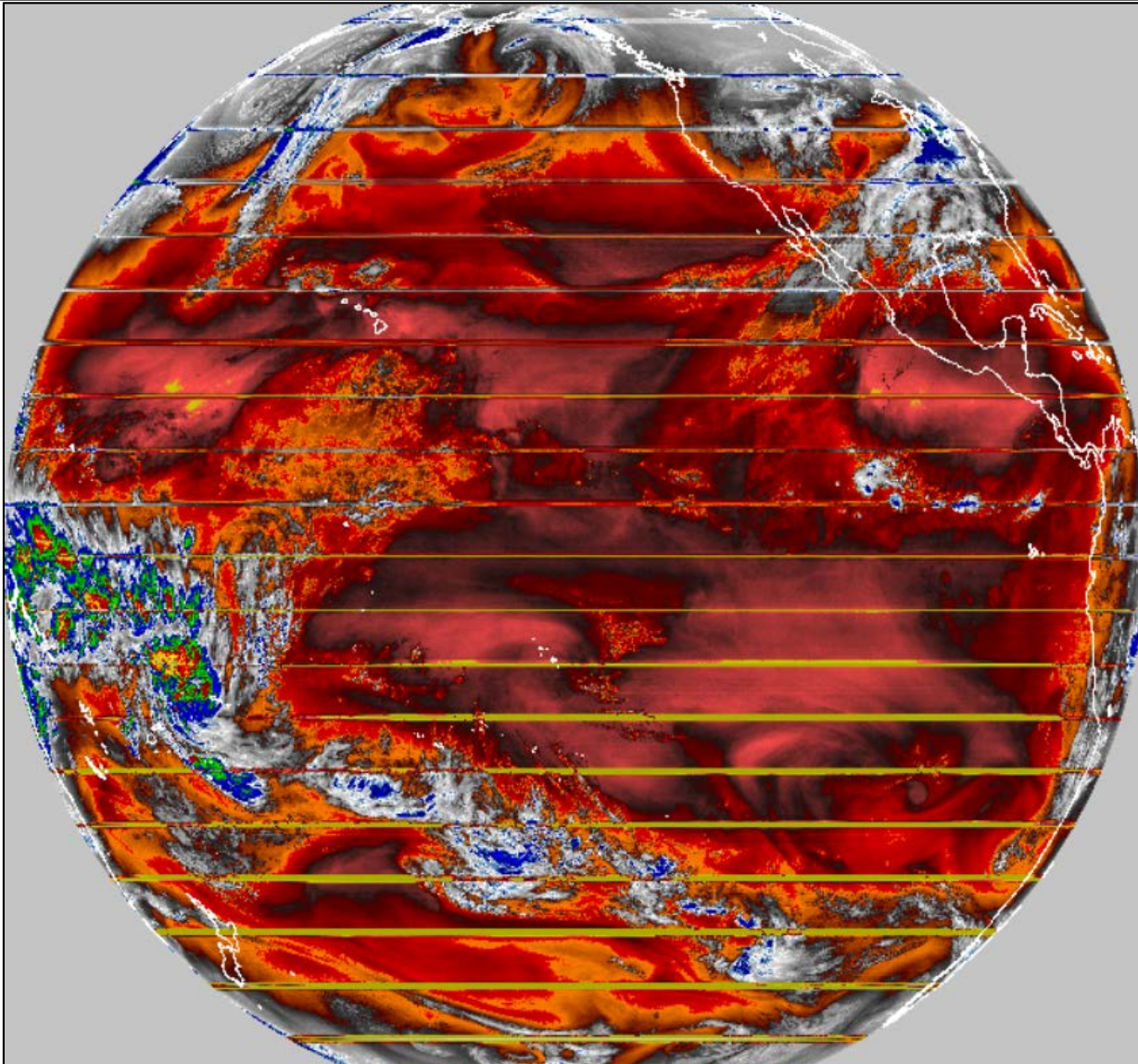


# Characterization of Marginal and Unusable Hours

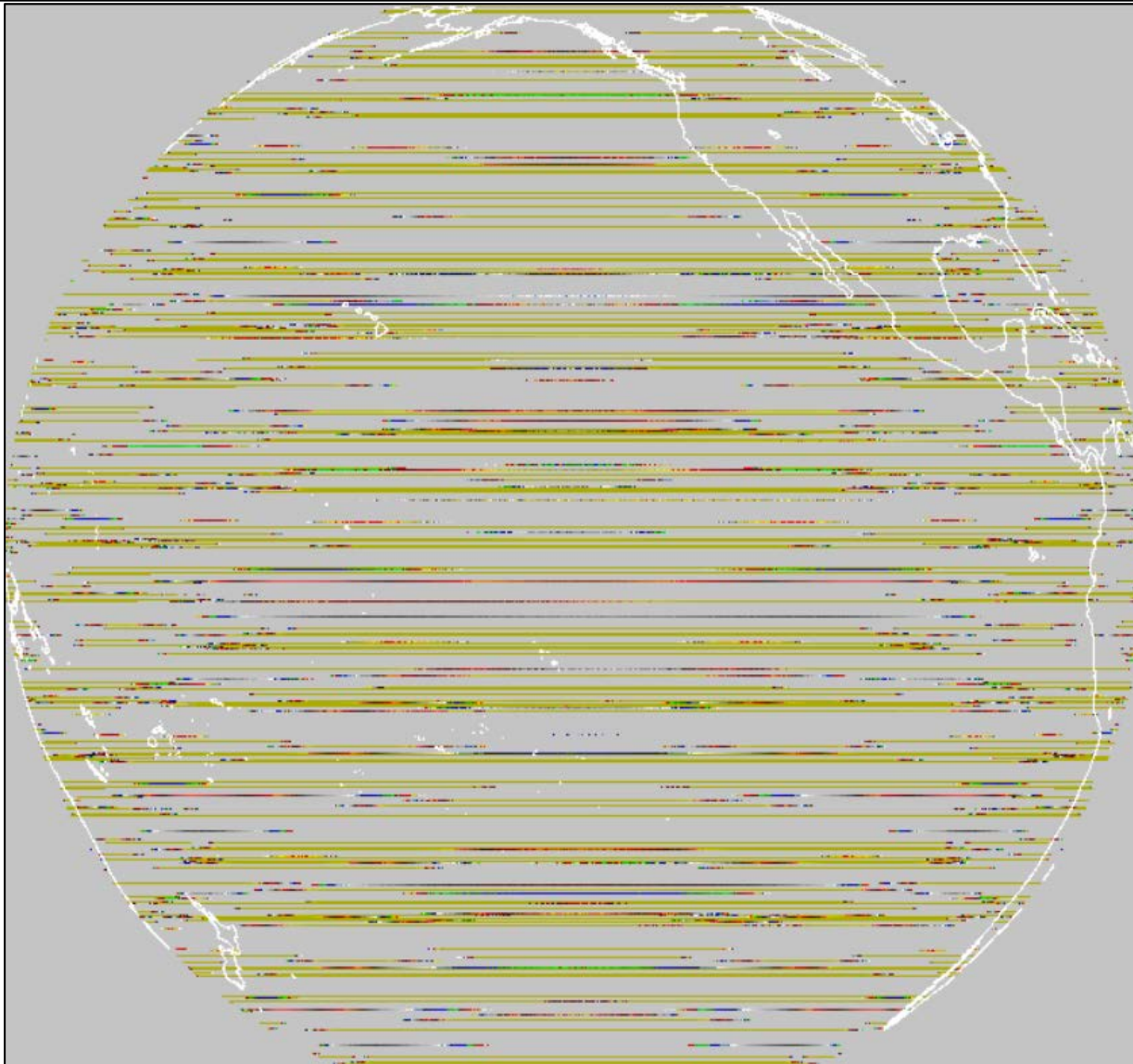
2020 Predictions	Characterization of Daily Maximum Values	Characterization of Diurnal Values
22 July – 12 August	Channel saturation begins starting with bands in this order: 12, 16, 10, 8, 9, 11 from marginal to unusable by the end of the time period.	Saturation may occur between approximately 1100-1530 UTC. Peak saturation occurs at the end of the time period at approximately 1300 UTC.
13 August – 30 August	The cooling timeline is implemented. Channel saturation begins starting with bands in this order: 12, 16, 10, 8, 9, 11, 15, 14 from marginal to unusable by the end of the time period.	Saturation can occur between approximately 1030-1600 UTC. Peak saturation occurs at the end of the time period at approximately 1300 UTC.
31 August – 7 September	After a 1-day spike when the cooling timeline is turned off, Channel saturation improves from September 1 <sup>st</sup> starting with bands in this order: 11, 9, 8, 10, 16, 12 from unusable to mostly marginal by the end of the time period.	Saturation can occur between approximately 1100-1530 UTC. Peak saturation occurs at the beginning of the time period at approximately 1300 UTC.
8 September – 6 October	All bands nominal without marginal or unusable periods.	Diurnal values remain within usable imagery thresholds throughout this period.
8 October – 15 October	Channel saturation begins starting with bands in this order: 12, 16, 10, 8, 9, 11, 15 from marginal to unusable to mostly marginable by the end of the time period.	Saturation can occur between approximately 1015-1600 UTC. Peak saturation occurs at the end of the time period at approximately 1300 UTC.
16 October – 30 October	The cooling timeline is implemented. Channel saturation improves starting with bands in this order: 11, 9, 8, 10, 16, 12 from unusable to mostly marginal by the end of the time period.	Saturation can occur between approximately 1015-1600 UTC. Peak saturation occurs at the end of the time period at approximately 1300 UTC.
31 October – 19 December	After a 1-day spike when the cooling timeline is turned off, Channel saturation continues to improve starting with bands in this order: 11, 9, 8, 10, 16, 12 from unusable to mostly marginal by the end of the time period.	Saturation can occur between approximately 1015-1600 UTC. Peak saturation occurs at the end of the time period at approximately 1300 UTC.



# Example of Marginally Saturated Image



# Example of Unusable Saturated Image

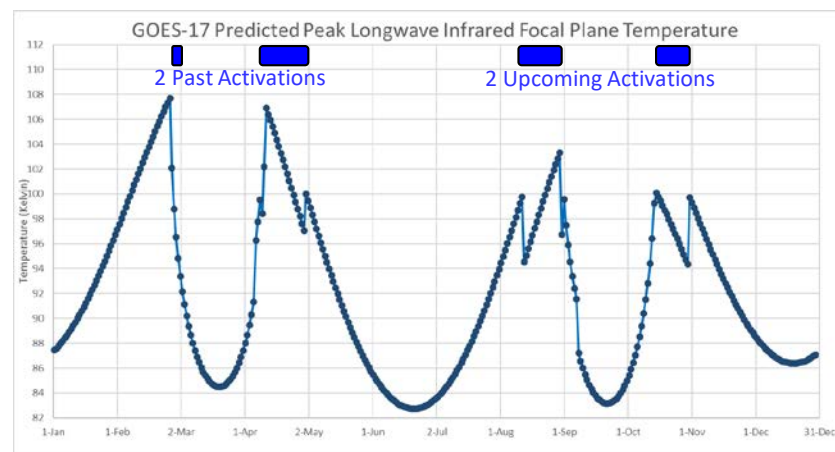






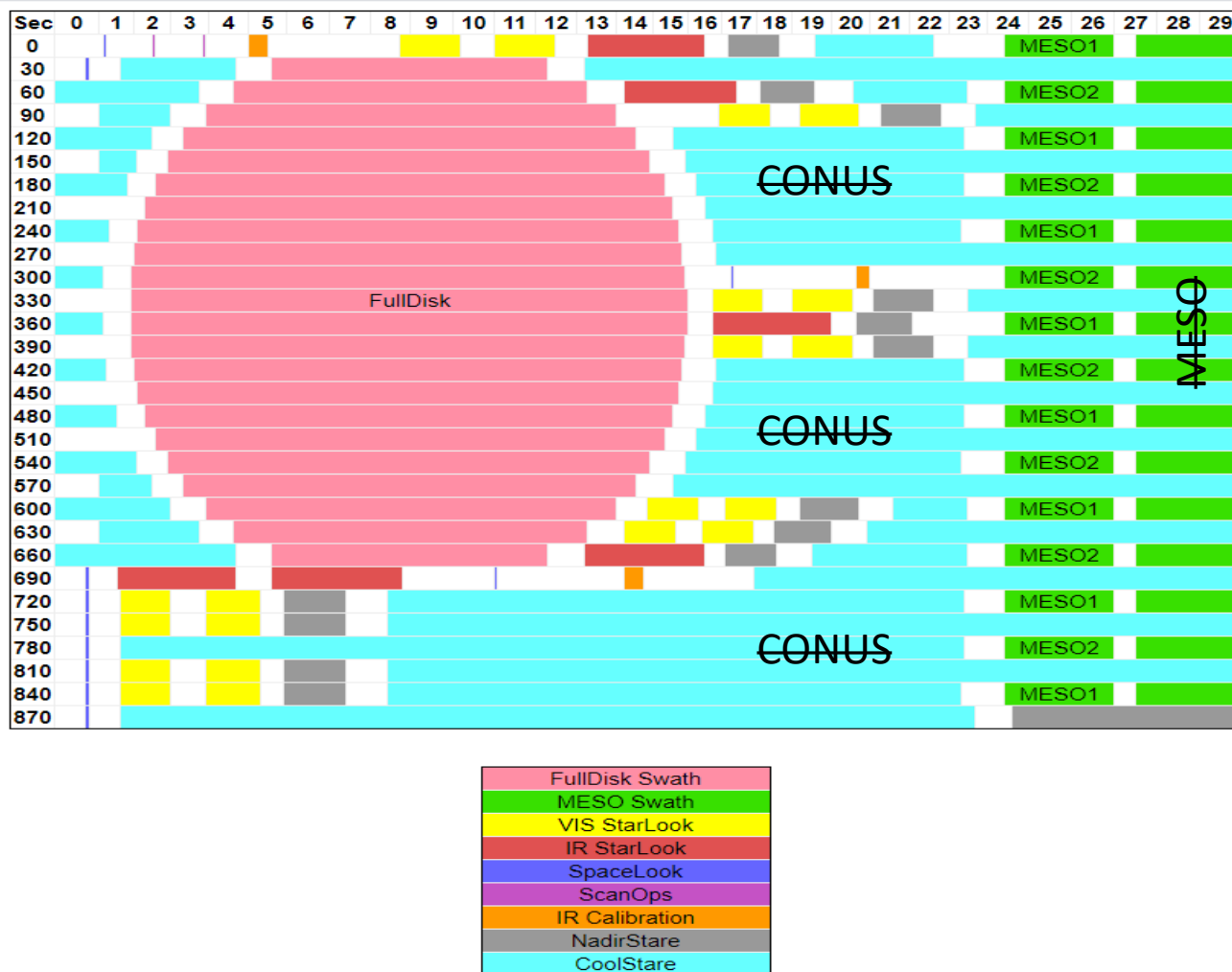
# Introduction to Cooling Timeline

- Objective: Lower focal plane temperatures and decrease hours of degraded and saturated imagery
- Approach: Alter ABI timeline to spend additional time looking at cool space-looks (vs. comparably hot Earth-looks)
- Timeline runs from 0600 UTC to 1200 UTC on days when cooling timeline is active
- Past Activations
  - Feb 26, 2020 – Mar 1, 2020
  - Apr 9, 2020 – May 1, 2020
- Upcoming Activations
  - Aug 11, 2020 – Sep 1, 2020
  - ~Oct 14, 2020 – ~Oct 31, 2020



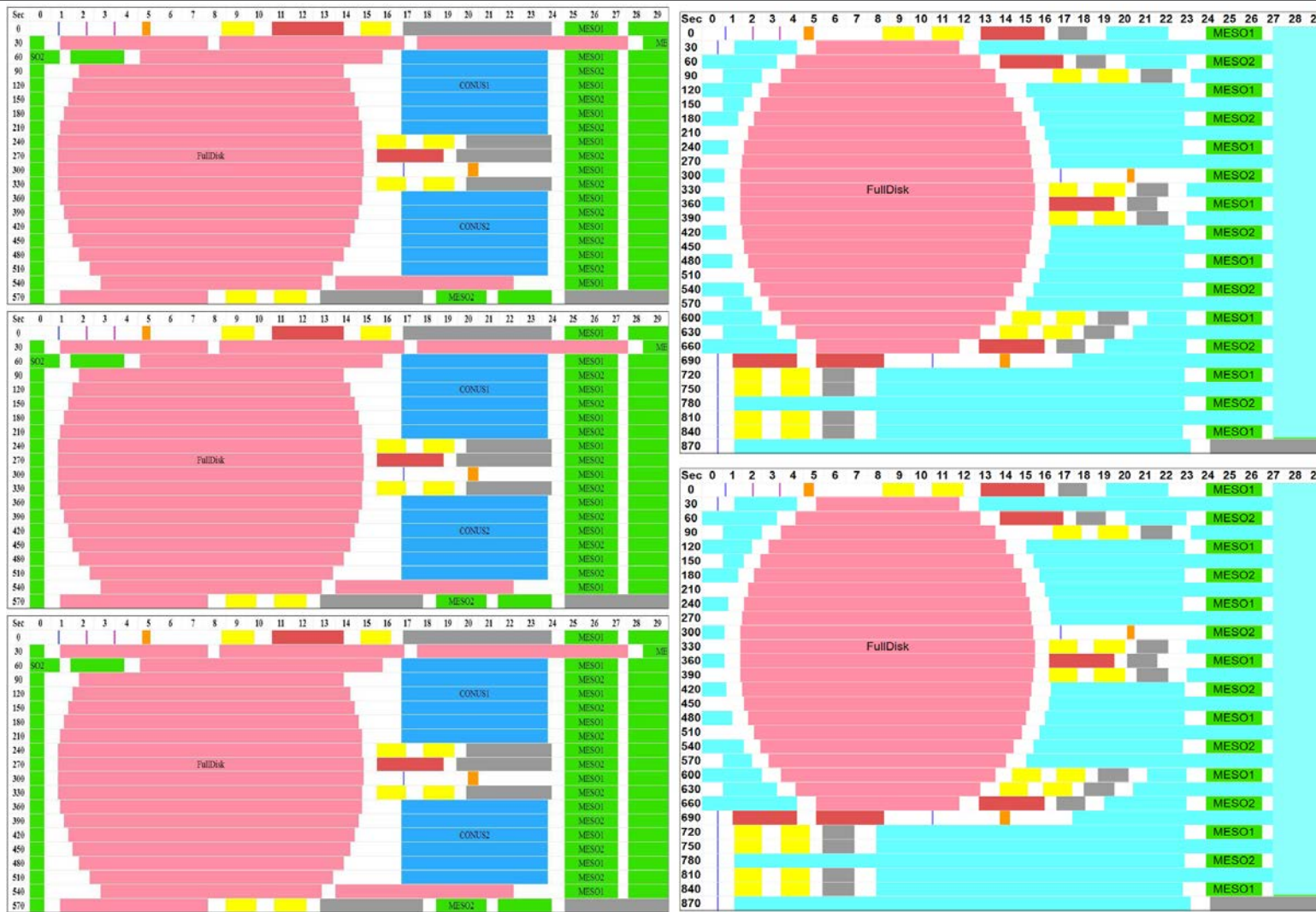
# Introduction to Cooling Timeline

- Classified as Mode 3:
  - 15 min Full Disk
  - No CONUS
  - Alternating MESO 1/minute
- Compare to Nominal Mode 6:
  - 10 min Full Disk
  - 5 min CONUS
  - MESO 2x1 min / 1x30 sec



Modified from [https://www.ospo.noaa.gov/Operations/GOES/west/Mode3G\\_Cooling\\_Timeline\\_G17.html](https://www.ospo.noaa.gov/Operations/GOES/west/Mode3G_Cooling_Timeline_G17.html)

# Introduction to Cooling Timeline



Over the same time period, replaces three nominal Mode 6 Timelines with two Cooling Timelines:

Full Disk: 3 to 2  
CONUS: 6 to 0  
MESO: 60 to 30

Modified from [https://www.ospo.noaa.gov/Operations/GOES/west/Mode3G\\_Cooling\\_Timeline\\_G17.html](https://www.ospo.noaa.gov/Operations/GOES/west/Mode3G_Cooling_Timeline_G17.html)



# Cooling Timeline Results Summary

- Cooling timeline effectively reduced the peak FPM temperature by  $\sim 3\text{-}5$  K from April 9 – May 1
  - Stronger impact on the hottest days
- The cooling timeline in April 2020 gained  $\sim 30\text{-}130$  minutes of valid images at most cooling days
  - 50-150 MESO images
  - 2-10 CONUS images
  - 2-6 FD images
- More extra images at the falling FPM temperature side than at the rising side
- No saturated images at B07/B13/B14 on cooling timeline days

Source: Fred Wu